

A CCD mosaic of an extended remnant in Cygnus

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Abstract

We present the first CCD mosaic ever produced for the supernova remnant G 65.3+5.7 in [O II] 3727 Å at a moderate angular resolution. The remnant was observed with the 0.3 m wide-field telescope at Skinakas Observatory, Crete, Greece. Low resolution spectroscopy was performed at selected areas around this extended remnant. The spectral data are under analysis, while a first processing of the imaging observations produced impressive results.

1 Introduction

Gull et al. (1977) reported the detection of a new supernova remnant during an emission line survey of the Milky Way. The remnant is found in Cygnus and is located a few degrees to the south-west of CTB 80. The wide field covered by this remnant was imaged on plates by the authors in the emission lines of [O II] and H α . Fesen et al. (1983, 1985) performed higher resolution imaging observations in [O III] 5007 Å of five (5) selected portions of the remnant and spectral observations at two (2) positions. Major characteristics of the remnant are its large extent ($\sim 5^\circ \times 4^\circ$), and its filamentary appearance in the medium ionization line of [O III]. The remnant is also detected in the radio survey of Reich et al. (1979), while the Einstein IPC mosaic shows very weak X-ray emission (Seward 1990). An average distance of ~ 1 kpc to this remnant is given in the literature.

2 Observations

The imaging observations were performed with a 1024×1024 Site CCD which in conjunction with the 0.3 m telescope at Skinakas Observatory resulted in a pixel scale of 5 arcseconds. Each field was observed for 1800 sec with this highly efficient CCD camera in [O II] and [O III]. The astrometric solutions were calculated with the aid of the Hubble Space Telescope Guide Star catalogue for all individual fields and then they were projected to a common origin for further processing.

The long-slit spectral observations were conducted with a 1300 line mm^{-1} grating and a 800×2000 Site CCD camera. This camera was mounted on the 1.3 m telescope at Skinakas Observatory and the range of 4750 Å – 6815 Å was covered at a scale of ~ 1 Å per pixel. The total exposure times are 7800 sec and standard IRAF and MIDAS routines were employed for the reduction of the data. The spectra are flux calibrated through the observations of several spectrophotometric standard stars.

3 Current preliminary results

In Fig. 1 we show the [O II] low ionization line image of G 65.3+5.7. Several new structures are discovered in this field which were not known before. Eventhough the [O III] mosaic is under preparation the comparison of the individual fields in [O II] and [O III] reveals several significant morphological differences (Fig. 2).

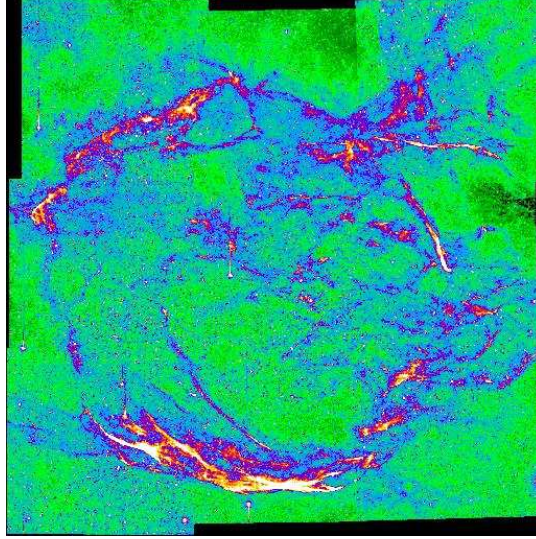


Figure 1. The remnant G 65.3+5.7 in the low ionization line of $[\text{O II}] 3727\text{\AA}$

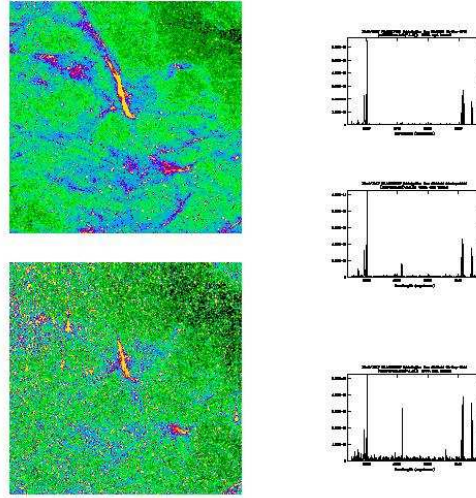


Figure 2. A specific portion of the remnant in $[\text{O II}]$ (top left) and $[\text{O III}]$ (bottom left) display different morphologies. The right plot shows typical spectra of the remnant showing very strong $[\text{O III}]$ emission.

The spectra analyzed up to now were taken in the south and south-west areas of the remnant and show the characteristic signature of emission from shock heated gas ($[\text{S II}]/\text{H}\alpha > 1.0$). In addition, these spectra display very strong $[\text{O III}]$ emission relative to $\text{H}\alpha$ and, even stronger of course, relative to $\text{H}\beta$. The measured values of the $[\text{O III}]/\text{H}\beta$ ratio lie in the range of $\sim 7\text{--}18$, suggesting the presence of both complete and incomplete recombination zones. Furthermore, the prominent $[\text{O III}]$ emission is indicative of shock speeds around $\sim 100 \text{ km s}^{-1}$ (Fig. 2). We measure the $\text{H}\alpha/\text{H}\beta$ ratio around 5 showing that the interstellar extinction absorbs moderate amount of light from the remnant.

A quick search in the ROSAT All-Sky survey data base revealed weak soft X-ray emission from G 65.3+5.7 (Fig. 3). It is evident that the X-ray emission is centrally peaked and is, roughly, bounded by the the outer $[\text{O II}]$ filaments. The survey photon event files were extracted and are under analysis in order to study in, as much detail as possible, the X-ray spectral properties of the remnant.

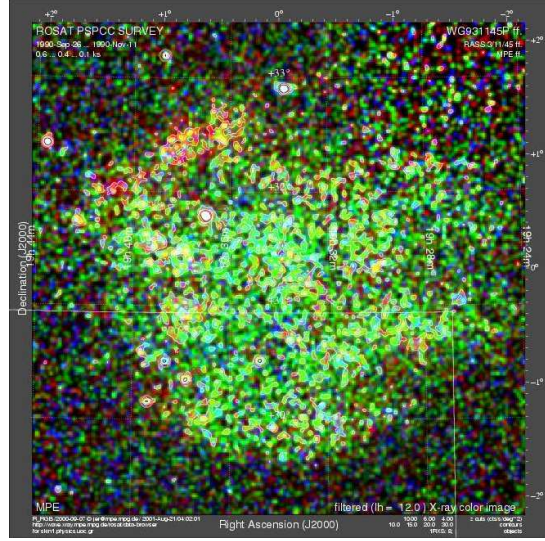


Figure 3. The X-ray image of G 65.3+5.7 in the 0.1–2.4 keV band observed by the ROSAT satellite during the All-Sky survey.

Acknowledgments

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